

DISEASES OF FRUIT TREES AND THEIR TREATMENT.

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The number of pests that attack cultivated plants is legion, many of which are now cosmopolitan, and this to such a degree that their country of origin is not always known for a certainty. It is well known that many plants and animals thrive better in a new country, than in the one to which they are indigenous. Some of the reasons for this is the absence of natural controls such as climate or the absence of parasites, either insects or fungi. An abundant food supply always favours this increase, and it is easily seen that where such crops as fruit trees are grown year after year this ensures an unbroken food supply to the pests attacking them, whereas the same pests attacking plants under purely natural conditions would have to travel greater distances to find suitable host plants.

In dealing with insect pests it should be borne in mind that the mission of many insects is to assist nature in removing trees that are low in vitality, so as to make room for healthy ones. This can easily be proved by ringbarking a perfectly healthy tree, and noticing how readily it is attacked by insects that previously left it alone. From this we learn the necessity of keeping trees and plants in as thrifty a condition as possible. In the economy of nature, many insects are useful in lessening the seed production of some plants, and thus aid in preventing their undue increase, but unfortunately they show no discrimination when plants of a kindred nature are being grown for profit.

In combating injurious insects by means of spraying, it is of the greatest importance that this should be done thoroughly, and care taken that no part of the sprayed plant is missed by the material, otherwise such insects as aphides are in a very brief time able to again infest the tree from a few surviving individuals.

With insects that secrete waxy filaments such as Woolly aphis, the nozzle of the spray pump should be held close up to the parts to be sprayed, so that sufficient force may be applied to wash away the flocculent protective covering beneath which the insect shelters.

The time of application, together with thoroughness, if combined with some knowledge of the pest to be fought, is the essential for success. Clean cultivation is also important, as, apart from its physical effect on the soil, it also destroys cover for pests of various sorts. The head-lands should be cultivated, for if allowed to support a riot of weeds, these are a prolific source of invasion of enemies to the fruit-grower.

The chief insects which the horticulturist has to combat may be grouped as follows:—

1. Chewing insects that feed on exposed leaf surfaces.

Examples.—Pear and Cherry Slug, Pumpkin Beetle and most caterpillars.

Treatment.—Spray with arsenate of lead.

2. Chewing insects that are exposed for only a short time.

Examples.—Codlin Moth, Light Brown Apple Moth.

Treatment.—Arsenical sprays. Picking affected fruit, and bandaging.

3. Chewing insects living in tunnels eaten out by them in stems or branches.

Example.—Cherry and Peach Borer Caterpillar.

Treatment.—Spraying is of very little or no value. Inject carbon bi-sulphide into tunnel and plug up entrance with soft clay.

4. Chewing insects that move freely about and often feed at night.

Examples.—Weevils.

Treatment.—Arsenical sprays. Root borer traps. Jarring insects from trees, collecting and destroying.

5. Suctorial insects, more or less permanently fixed to their host plant.

Examples.—Scale insects.

Treatment.—Oil sprays or fumigation with hydrocyanic acid gas.

6. Suctorial insects that move about on branches.

Examples.—Aphides, Red Spider.

Treatment.—Oil sprays when trees are dormant and tobacco sprays when trees are active.

7. Suctorial insects that are free-moving and active fliers.

Examples.—Rutherglen and other plant-feeding bugs.

Treatment.—Phenyle sprays.

8. Fly maggots infesting fruit.

Examples.—Fruit flies.

Treatment.—Destroy infested fruit by boiling, keep soil beneath trees well stirred. Spraying is of no value.

From the diversity of insect pests attacking fruit trees, it can be seen that before attempting to combat them a true diagnosis of the disease must first be made, as in the case of disease attacking higher life, otherwise the operator can have but little hope for success. If a correct diagnosis be not made, a fungicidal spray may be applied when it should have been an insecticide, or *vice versa*.

The following remedies given are those commonly advocated by officers of this branch.

Codlin Moth.—The eggs are usually deposited on fruit or leaves at intervals of time. The caterpillar, on hatching, feeds for some time on the hair-like threads in the eye or calyx of the apple, and later usually enters the fruit at this point. This applies principally to caterpillars of the first brood, later broods entering the fruit at any point. Spray trees with arsenate of lead (1 lb. to 20 gallons of water) before the calyx or eye of fruit closes; give a second application from ten to fifteen days later, and subsequent sprayings should be given at intervals of not longer than thirty days, four or five sprayings being necessary—the latter number for late varieties.

Cherry and Pear Slug.—Spray with arsenate of lead as soon as leaves have developed, and while the fruit is small and green. A second spraying, if necessary, can be made after the fruit has been picked.

Root Borer.—So far, the only methods adopted for coping with this pest are by trapping and poisoning with arsenate of lead; trees sprayed on warm days give better results, owing to the beetles drinking the liquid, than on cool days. Trees should be regularly examined for beetles from spring until January.

Woolly Aphis.—Orchards in low-lying, damp situations are the most difficult to keep clean, some varieties of apples, notably the Rokewood,

Spitzenberg, Statesman, Granny Smith, and Rome Beauty, amongst leading varieties, being specially prone to attack from these insects. Thoroughness in spraying is of the greatest importance, and care should be taken not to allow galls to form, as after these have developed the difficulties of eradication are enormously increased. The spray should be applied first as soon as leaves have fallen, or even earlier, and the second spraying should be given early in August. For these applications use red oil at a strength of one gallon of oil to 25 gallons of water. If aphids be present in summer, the trees may be sprayed with tobacco water, made as follows:—Soak 1 lb. of tobacco stems in $1\frac{1}{2}$ gallons water (first placing tobacco in a bag); if washing soda is added at rate of $\frac{1}{2}$ lb. to every 50 gallons of water, it will greatly assist in the extraction of the nicotine.

Peach Aphis.—The most effective treatment for these pests is a thorough spraying with red oil in early spring or late winter at strength of 1 in 30. For dealing with these aphides after the trees have become active, make a thorough spraying with tobacco wash—2 lbs. tobacco to 4 gallons water.

Mussel Scale.—Spray in early winter with red oil—1 gallon of oil being used to 20 of water. All loose bark, &c., should be removed from tree. Watch trees closely in spring (usually about November) for young scales hatching, a tobacco spray at this time being very effective.

San Jose Scale.—The same treatment as recommended for mussel scales during dormant period. For summer treatment, use the self-boiled lime-sulphur wash at summer strength, choosing a cool day for that purpose. Sixteen pounds of fresh burnt lime or 13 lbs. of flowers of sulphur, will suffice to make 80 gallons of winter spray or 240 gallons of summer spray. To prepare, place lime in barrel which has previously been rinsed with boiling water to warm it; mix the sulphur in a convenient vessel with boiling water added slowly, until the sulphur is well mixed into a somewhat stiff paste, then add more boiling water, 4 gallons in all. The lime in the barrel should be slaked simultaneously with four gallons of boiling water, and the sulphur mixture added. Stir the lot up well with a wooden spade or flat stick, and then cover up with two or three bags to retain the heat. If everything is done promptly, the mixture should continue to boil for 30 minutes. It is best used when freshly made.

Olive Scale.—During the winter months it is difficult to reach these insects when infesting citrus trees, and the most effective time for dealing with this pest is in March, either by fumigation or spraying. At this time of the year these insects are mostly small and immature, and the trees, having at this time ripened their growth, are less liable to sustain damage from either gas or oil applications. Red oil may be applied at a strength of 1 in 40. When this scale occurs on deciduous trees, they can be treated with red oil at winter strength during the winter months. The same treatment can be given for the Red scale.

In dealing with scale insects it should be borne in mind that it is difficult to destroy matured scales and their eggs, but when first hatched the young are exceedingly delicate little creatures, and are at this stage easily killed by almost any weak contact insecticide. But if they are permitted to settle down and start feeding, they immediately commence to form the protecting scale, and as this increases in size so the difficulties in reaching the insect beneath becomes greater, and consequently washes of greater strength become necessary.

Rutherglen Bug or Chinch Bug (Lygaeidae).—These insects, often wrongly called flies, are very destructive, feeding mostly on grasses or shrubs, and in some seasons becoming very serious pests to the orchardist and farmer.

When these bugs make their appearance in plague numbers, the most effective treatment, as well as the cheapest, appears to be spraying them with phenyle, the formula for its preparation being as follows:—Boil 1 bar of yellow soap with 3 lbs. of washing soda until thoroughly dissolved, then add 1 quart of phenyle and make up to 40 gallons with water. If preferred, Benzole emulsion could be used at strength of 1 in 4, but this is a much more costly preparation than the phenyle.

Fruit Bugs (Pyrrhocoridae), commonly called Soldier bugs, are frequently a pest in suburban gardens. They are exceedingly fond of greasy bones, and if a few of these be laid down (the large bones are best), where these insects most congregate, they will attack the bones in large numbers, and they may then be easily killed by pouring boiling water over them. This at the same time brings more grease to the surface of the bones, thus keeping them attractive to the bugs. In dealing with plant bugs, clean cultivation is of the very first importance.

Red Spider.—Spray when trees are dormant with red oil at winter strength—1 in 30.

Thrips.—These insects are often troublesome to late blooming varieties of apples, particularly the Five Crown and Rome Beauty, and especially so should the spring prove a dry one. Oil applications during the winter months probably affords some slight protection, but thoroughly spraying the trees with tobacco wash (same strength as for aphids) as soon as thrips start to become plentiful is the best method of control. Spraying must be thorough to be effective. The mixture should be applied at high pressure, and forced down on to the ends of the buds rather than applied on their sides. The nozzle should be held close to the buds, two or three sprayings being usually necessary. In preparing tobacco sprays, the tobacco should not be boiled, but placed in a bag and allowed to soak for three or four days.

FUNGUS DISEASES.

Fungus diseases are caused by minute vegetable organisms attacking plants of a higher order, and in some seasons the losses caused are very serious, and humid conditions are very advantageous for most of them. Where the drainage of land is bad, the conditions are usually very favorable for the rapid propagation of these minute plants. In spraying against fungus diseases, it should be borne in mind that treatment should be always preventative rather than curative, for once these organisms enter their host plant they are beyond the reach of effective treatment. The aim of the horticulturist should be to coat with a fungicidal spray the plant to be protected, so that the spore of the disease, on germination taking place, would come into contact with the fungicide that separates it from its host plant, and thus cause its death. If the tree has not been protected by coating it with a fungicide, the spore on germination sends out mycelial threads, which find their way beneath the skin of the host plant and commence to feed on its tissues. The skin and tissue of the affected parts are killed, and it is the inability of these dead parts to expand and keep pace with the growing parts of fruit that causes the cracks in apples and pears when attacked by Black Spot fungus.

Black Spot or Scab in Apples and Pears.—Spray trees as soon as buds separate from one another, so that the spray can run down the flower stalk, using either Bordeaux Mixture (6.4.50 formula) or Copper Soda Spray (6.8.50 formula—6 lbs. blue stone, 8 lbs. washing soda, 50 gallons water); for late or summer spraying, using this at half strength.

Shot Hole of Stone Fruits.—Spray with Bordeaux Mixture or Copper Soda before flowers open. Spraying as soon as leaves have fallen is advised for trees that have suffered badly from attacks of this disease.

Peach Curl.—Spray with Bordeaux Mixture as soon as buds swell in spring, and just before the leaf buds burst. A spraying with blue-stone (1 lb. in 25 gallons of water) has given good results when immediately followed by an oil spray at strength of 1 in 25.

Shot Hole of Apricot.—Spray with Bordeaux Mixture or Copper Soda spray when the buds are showing pink.

Armillaria.—This is a root-killing fungus, and is very destructive to trees in certain soils, such as some of the red and sandy soils that have a cement-sub-surface, especially on land that has not been thoroughly cleaned of roots of native trees previous to planting. Several remedies are recommended for coping with this disease, among which Sulphate of Iron, Bordeaux Mixture, and Bordeaux Paste are the principal. One thing that should be borne in mind is that summer treatment is likely to prove dangerous to the tree. Bordeaux Paste is applied after baring the roots, which, if done in hot summer weather, must be injurious to the tree. Again, if drenching with a fungicide to the soil sufficient to reach the disease on the roots is given in hot weather, when the roots are in a most active condition due to the rapid transpiration of water by the leaves, trouble is likely to result, and probably the tree will die. The best time to make root applications is during the winter months, or after heavy rains in autumn.

Bordeaux Paste is made as follows:—

Sulphate of Copper (Bluestone), $1\frac{1}{2}$ lbs.

Quicklime, 1 lb.

Water, 2 gallons.

Remove soil and apply to roots with a brush.

Bordeaux Mixture, 6.4.50, sprayed on roots.

Sulphate of Iron, 1 lb. in 4 gallons of water, sprayed on roots.

In preparing Bordeaux Mixture three vessels are used, preferably of wood (iron vessels must on no account be used in its preparation). Formula, Bluestone, 6 lbs.; Quicklime, 4 lbs.; Water, 50 gallons. Dissolve the bluestone in a barrel with 25 gallons of water, and in another barrel slake the lime and make 25 gallons of lime-water. These two lots of 25 gallons should be poured evenly into a third vessel, keeping it well stirred at the same time. A test can be made on this mixture by inserting a clean knife-blade into it for a minute or two; if the steel bronzes it shows the presence of free copper in the solution, and a little more lime should be added until the knife-blade shows clean. In bad seasons, it may be of advantage to lessen the water to 40 gallons, both in the Bordeaux Mixture as well as in the Copper Soda spray. In the preparation of the latter spray, the same method is adopted as in the Bordeaux, only the washing soda takes the place of lime. In the preparation of any spray, good, soft water should be used. Bordeaux

requires stirring before using; this is usually done when running the lime-water and bluestone into the spray pump or third vessel.

Bordeaux Mixture (French method) is made up as follows:—

Materials.

Copper Sulphate, 10 lbs.

Fresh Quicklime, 5 lbs.

Water, 50 gallons.

If the lime is of poor quality or air-slaked, more than 5 lbs. will be required.

Utensils.

A 60-gallon hogshead with one head removed; pegs should be inserted inside to show the 10 and 50-gallon levels.

Two or three kerosene tins for boiling water in.

A tub or tin to slake the lime—capacity about 10 gallons.

An earthenware jug or jar—capacity 1 gallon.

A dipper—enamelled or painted inside and out.

A fine sieve.

Some phenolphthalein testing paper.

A broom-handle to stir with.

Operations.

Dissolve the copper sulphate in 5 gallons or so of hot water, make up to 10 gallons with cold water.

Remove one gallon of this solution in the earthenware jug or jar and place it to one side.

Add about 20 gallons of water to the copper sulphate solution in the cask (this need not be measured).

Slake the quicklime by adding small quantities of water at a time. When slaked, add water sufficient to make about 6 or 8 gallons of milk of lime.

Pour this lime milk through the sieve into the bulk copper sulphate solution, with brisk stirring until neutralized. Neutralization is shown by the phenolphthalein paper turning pink. Stop adding lime milk as soon as the test paper turns faintly pink. (The test paper can with advantage be pinned to a small stick to avoid touching with fingers wetted with lime water, which would result in misleading indications.)

Add 1 gallon of Copper Sulphate solution previously withdrawn; stir thoroughly.

Make up to 50 gallons with water, and stir again.

The mixture is now ready for use. It should be used fresh, only sufficient for the day's requirements being made up at one time.

A stock solution of Copper Sulphate—1 lb. to 1 gallon of water—may be made up. This will keep indefinitely. Ten gallons of this stock solution should be taken for each cask of mixture. Copper Sulphate Solution must not be handled in iron or tin vessels unless these have been very thoroughly painted or tarred both inside and out. wood or enamel vessels are to be preferred. Copper Soda may be prepared in similar manner to above, but about half as much again of soda would be required, as in the case of lime. Phenolphthalein test paper can be obtained from any chemist. It consists of strips of white filter paper wetted with a 5 per cent. solution of phenolphthalein in methylated spirit and allowed to dry.

Collar Rot in Citrus Trees.—Cut away diseased bark until healthy tissues are met with, and swab parts with carbolic acid and water in equal parts. Covering wounds with grafting wax, &c., facilitates rapid healing.

Chlorosis is recognised by the leaves showing pale yellow blotches due to the lack of chlorophyll. The best treatment for trees so affected is an application of 1 lb. superphosphate with $\frac{3}{4}$ lb. of sulphate of iron per tree

BEE-KEEPING IN VICTORIA.

By F. R. Beuhne, Apiculturist.

XXVI. THE HONEY FLORA OF VICTORIA.

(Continued from page 307, Vol. XV.)

THE BOTTLEBRUSHES (*Callistemon*).

The Bottlebrushes are a genus confined to Australia. There are sixteen species, eight of which are native to Victoria. They are closely allied to the Honey Myrtles or Bottlebrush Tea-trees (*Melaleuca*), which they resemble remarkably in their floral characters, differing from them, however, in the length and breadth of their leaves and the length and colour of the stamens of the flower. The features which distinguish the Bottlebrushes from the Honey Myrtles or Bottlebrush Tea-trees are the larger leaves as well as the longer stamens of the former, which are always over half an inch in length while those of the Honey Myrtles do not exceed half an inch.

All the Bottlebrushes yield nectar and pollen, and although the honey obtained from them cannot be considered of the best quality, these shrubs are nevertheless of great value to the bee-keeper in the localities where they grow, as they provide nectar and pollen in October, November, and December, according to the species, a time when both these bee foods are most needed for the full development of the colonies.

THE CRIMSON BOTTLEBRUSH (*Callistemon lanceolatus*).

The Crimson Bottlebrush is usually a tall tree, sometimes attaining a height of 30 feet, but occasionally the shrubs are low and bushy. The leaves are lance-shaped, variable in breadth, usually pointed, and from $1\frac{1}{2}$ to 2 inches long, but varying from 1 to 3 inches. The crimson flower spikes are from 2 to 4 inches long, and not very dense. The petals are greenish or reddish, and the stamens crimson, in some specimens deeply coloured, in others much paler, more slender, and scarcely above half an inch in length. The Crimson Bottlebrush is found in East Gippsland. It yields both nectar and pollen, and flowers generally in October.

THE SCARLET BOTTLEBRUSH (*Callistemon coccineus*).

A shrub very closely allied to the Crimson Bottlebrush. The leaves are lance-shaped, rigid, almost pungent, from 1 to $1\frac{1}{2}$ inches long, the mid rib prominent. The flowers are scarlet, not very dense, stamens $\frac{3}{4}$ to 1 inch long, with yellow anthers.